Is there duration dependence in local governments' tenure?[*]

Vítor Castro[a, ♣]

[a] Faculty of Economics, University of Coimbra, Portugal
and Economic Policies Research Unit (NIPE), Portugal

Rodrigo Martins[b]

[b] Faculty of Economics, University of Coimbra, Portugal
and Group for Monetary and Fiscal Studies (GEMF), Portugal

Abstract

This paper analyses the presence of duration dependence in local governments' tenure. Employing a Weibull duration model over a set of spells of time in office during the period 1979-2005, we show that the more time a party remains in office, the higher the likelihood of not running for another term is. However, more flexible polynomial-in-time and time-dummies specifications show that the behaviour of that likelihood is not monotonic: it increases but only until the third term, then it decreases until about the sixth term before starting to increase again. This study also shows that the likelihood of an incumbent party leaving office, given his tenure, is affected by the local economic environment and political support.

Keywords: Terms in office; Portugal; Duration dependence, Parties.
JEL classification: D72; H79; C41.

---

[*] The authors thank the financial support provided by the Portuguese Foundation for Science and Technology under research grant PEst-C/EGE/UI3182/2011 (partially funded by COMPTE, QREN and FEDER).

[♣] Corresponding author. *Address*: Faculty of Economics, University of Coimbra, Av. Dias da Silva 165, 3004-512 Coimbra, Portugal. Tel.: +351 239 790526; Fax: +351 239 790514; *E-mail*: vcastro@fe.uc.pt

1. Introduction

A significant body of research focusses on the performance of democracy. The importance of this topic made it a relevant subject in several fields of political science and public choice, and different perspectives and approaches, directly or indirectly, tackle the question of democracy's efficiency. This paper analyses the presence of duration dependence in Portuguese local governments' tenure and the impact of some explanatory variables that are known to contribute to varying levels of electoral security. Whether one considers the duration in office to be a measure of democratic stability, policy continuity, or even executive dominance over the legislature, it is a subject that contributes to a better understanding of how democracy works.

Tenure in office and its determinants have received extensive scholarly attention. Research on this area has been focused in phenomena such as cabinet duration, government survivability in parliamentary democracies, leadership tenure and career management. In this article we deviate from the more standard approaches and investigate party tenure as another aspect of political stability. We believe that this approach offers new insights and complements the existing literature. First, national governments termination has been the main subject of attention, and studies related to second order elections generally approach duration in the perspective of leadership tenure and politicians career management, and they are mainly focused on the United States. Portugal offers an alternative perspective as it is characterized by a multiparty proportional system. Second, research on party duration remains, to our knowledge, quite limited. Third, the emphasis on parties is useful in capturing major political changes and allows the examination of party incumbency hazards beyond the boundaries of a single administration. Political parties are ideologically heterogeneous and they all have different policy agendas, meaning that the political and economic impact of a change in governing parties is usually more significant than governing modifications that do not imply changes in the ruling party. The economy is

particularly affected by party switching and partisan aspects of political cycles are well documented in the literature (see, for instance, Hibbs 1977; Alesina et al. 1997). Cycles in elections are essential to the competitiveness of democracy since they prevent one-party dominance. We find these cycles throughout all democracies which suggests rising hazards of party incumbency. However these changes bring about policy shifts that affect primarily the stability of the economy but also entail social aspects. In this perspective the study of party incumbency allows us to check how the democratic process balances competitiveness with stability.

To analyze the patterns of tenure in local elections we use an extensive data set that covers all mainland municipalities for the period 1979-2005. The Portuguese case offers an interesting scenario for this analysis for some reasons. First, election dates are fixed and defined exogenously from the perspective of local authorities. Second, all municipalities have elections on the same day. Third, there are no reelection institutional constrains because there is no legal limit on the number of terms a mayor can remain in office during the time span considered in this study.[1] Finally, local incumbents have a key influence in local policy and outcomes.

In this article, we provide a methodological framework to study local party duration in office. Duration models are employed to examine for the presence of duration dependence in the time in office of political parties. The impact of some economic and political variables is also taken into account. Estimating continuous and discrete-time Weibull duration models, this study provides evidence of positive duration dependence and confirms the impact of some economic and political factors on the length of time a party is in office. Additionally, more flexible polynomial-in-time and time-dummies specifications indicate that the behavior of the hazard function is not monotonically increasing but it

[1] In 2005 the Portuguese parliament issued a law limiting the number of terms to three. However, it will only have a real impact in the 2013 local elections as the count started for all mayors in the 2005 elections.

behaves in a nonlinear way: it increases until the third term, then it decreases until about the sixth before starting to increase again. This represents an important finding of this paper and contributes to the understanding and characterization of party tenure at the local level.

The remainder of this paper is organized as follows. Section 2 presents a review of the literature. The data and the econometric model are described in section 3. Section 4 discusses the main empirical results and Section 5 concludes.

2. Literature

One first approach to the analysis of democratic stability is to study cabinet durability in parliamentary democracies, investigating the duration of national governments and why they are often dissolved prior to elections.[2] Early works, such as Taylor and Herman (1971), Laver (1974), Dodd (1976), Warwick (1979), and Strom (1985) identify statistically the attributes that prolong or reduce governments' time in office, such as majority status, ideological compactness and party system fragmentation. Later, some research moved from this deterministic analysis to an essentially stochastic approach that highlighted the importance of external critical events such as international conflicts, economic crises and scandals to the survivability of incumbent administrations (see Browne et al. 1984 and Frendreis et al. 1986). The joining of these two perspectives came with the event-history method for analyzing government durations proposed by King et al. (1990) that although stochastic in nature allowed for the hazard rate of governments to depend on a set of independent variables, including particular governments' attributes. They showed that majority governments last longer and the more fractionalized party systems are the greater the risk of termination is. Using a similar approach Warwick (1994) found that rising inflation and unemployment and also high levels of ideological diversity contribute to an increase in the risk of termination. Other applications and developments were made

[2] For an encompassing survey, see Laver 2003.

making this approach the standard method of analyzing cabinet duration (see Warwick and Easton 1992; Warwick 1992, 1994; Alt and King 1994; Diermeier and Stevenson 1999, 2000; Diermeier and Merlo 2000; Finocchiaro and Lin 2000).

One of the advantages of the event-history method is allowing the analysis of the risk of termination over the course of a government's life. King et al. (1990) seminal work considered the risk of collapse to be time invariant while Warwick and Easton (1992) and Warwick (1994) found evidence that hazard rates increase during the lives of governments. Alt and King (1994) found limited support for this hypothesis of increasing hazard rates. In a more recent work for the impact of US congressional tenure on the hazards of electoral termination, Finocchiaro and Lin (2000) point out that the behavior of the hazard rate may not be monotonic. They show that the likelihood of an electoral defeat decreases at the early stage of a member's career, with the incumbent becoming entrenched in safe seats after the third term. From then on the hazards remain relatively stable, with the fatigue effect showing up only after the tenth term.

By definition, government termination occurs in one of the following scenarios: (i) there is an election; the partisan composition of the cabinet changes; (ii) the government voluntary or involuntary resigns with the accordance of the head of state; (iii) the Prime Minister changes.[3] Our work is focused on the duration of Portuguese local governments were almost all terminations are caused by constitutionally mandated elections. Portuguese local governments are generally stable and conclude their mandates. However, contrary to some studies that face the potential problem of finding misleading results because of constitutional maximums to the number of terms, Portuguese mayors and local governments have no such limit in the time span considered for this study: the inherent weaknesses (strengths) of governments are mainly exposed at elections.

[3] Browne et. al. (1984). For a survey on the various definitions of government termination see Lijphart (1999).

Some studies instead of focusing on governments' duration try to analyze the length of political leaders' tenure.[4] In this article we deviate from these two approaches and investigate party tenure as another aspect of political stability. Maeda and Nishikawa (2006) examine the difference of presidential and parliamentary systems regarding government durability using the length of time governing parties stay in the executive office, while Lin and Guillen (1998) examine changes and durations of party control in the United States presidential elections.

Changes in governing parties generally result in more policy modifications than government composition changes, therefore the survivability of parties in office is an important perspective of democratic stability, especially in the socioeconomic dimension. Even though survival in office depends partially on voter behavior, governing parties that lose votes do not always lose elections, making duration analysis a different angle to electoral competition. Party tenure in office is dependent on the passage of time, and we find in the literature two contending hypothesis concerning its effect: incumbency may be a liability or an asset (Rose and Mackie 1983). The argument of political erosion related to failures, political crises and other negative national or international events implies that incumbency is a liability.[5] According to the second hypothesis, incumbency gives parties a considerable advantage regarding resources, in particular, because they have control over the bureaucracy, solid patronage networks, access to privileged information and control over the economic policy. Therefore, the longer a party stays in government the more resources it has at its disposal to maintain its position. Whether and under what conditions incumbency is an advantage or a disadvantage for a party's survival in power is an empirical question that remains without a clear answer.

[4] See, for instance, Bienen and van deWalle (1991).

[5] Evidence of popularity erosion over time in office is well documented in the voting literature. See, for example, the seminal paper by Mueller (1970). Veiga and Veiga (2004, 2010) also report the existence of costs of ruling for Portuguese governments.

3. Data and econometric model

The data used in duration analysis consist of spells. In this study, a spell represents the number of terms a party is in office (*TLGov*). The data were collected for the 278 mainland Portuguese municipalities over the period 1979-2005, covering 8 electoral periods. Several economic, political and individual variables are used as regressors in this duration analysis. A complete description of all the variables employed in this study and the respective descriptive statistics for the sample used in the estimations can be found in Table 1 and Table 2, respectively.

[Insert Table 1 around here]

[Insert Table 2 around here]

Duration analysis has been widely used in labour economics to study the duration of periods of unemployment.[6] King et al. (1990), Warwick and Easton (1992), Warwick (1994) and Alt and King (1994) introduced and developed this methodology to national governments, cabinets and political leaders' survivability analyses. In a more recent study, Finocchiaro and Lin (2000) looks at the impact of US congressional tenure on the hazards of electoral termination. We extend these applications to the study of party tenure at local governance, defining the duration variable as the number of consecutive terms a party remains in office at the local level in Portugal (*TLGov*).

Two basic functions for duration analysis are the hazard function ($h(t)$) and the survivor function ($S(t) = \exp\{-\int_0^t h(u)du\}$). The hazard function measures the rate at which parties leave office at the end of term *t*, given that they remain in the office during

[6] See Allison (1982) and Kiefer (1988) for a review of the literature on economic duration analysis. The description of the duration models used in this study follows the works of those authors.

that term, i.e. $h(t) = P(T = t \mid T \geq t)$, where T is a random variable that indicates the time at which the event occurs. The survivor function measures the probability of party's incumbency to be greater than or equal to t, i.e. $S(t) = P(T \geq t)$.

The hazard function is useful to characterize the dependence path of duration. If $dh(t)/dt>0$ in moment $t=t^*$, then there is positive duration dependence in t^*, which means that the probability of a party leaving office at moment t, given that it has stayed until t, increases with t. An opposite conclusion is reached if the derivative is negative. There will be no duration dependence if the derivative is equal to zero.

The hazard function can be estimated by parametric methods. A functional form that is usually employed to parameterize the hazard function is the proportional hazards model:[7]

$$h(t, \mathbf{x}) = h_0(t)e^{\boldsymbol{\beta}'\mathbf{x}}, \quad \textbf{(1)}$$

where $h_0(t)$ is the baseline hazard function that captures the dependency of the data to duration, $\boldsymbol{\beta}$ is a $k\times1$ vector of parameters to be estimated and $\mathbf{x}$ is a vector of covariates. The baseline hazard is often characterized by a Weibull distribution:

$$h_0(t) = \gamma p t^{p-1}, \quad \textbf{(2)}$$

where $\gamma>0$ is a constant term and $p>0$ is the duration dependence parameter. If $p>1$, there is positive duration dependence; if $p<1$ there is negative duration dependence; no duration dependence is found if $p=1$. Hence, by estimating p, we can test for duration dependence in parties' incumbency. This model can be estimated by Maximum Likelihood and the corresponding log-likelihood function for a sample of $i=1,\ldots,n$ spells can be written as follows:

$$\ln L = \sum_{i=1}^{n} \left[c_i \ln h(t_i, \mathbf{x}_i) + \ln S(t_i, \mathbf{x}_i) \right], \quad \textbf{(3)}$$

[7] This means that the ratio of the hazard rates for any two observations is constant over time.

where c_i indicates when observations are censored.[8]

Nevertheless, this continuous-time duration model may not be the most adequate model to employ in this analysis. Although the length of time a party is in office is a continuous-time process, available data are inherently discrete (terms).[9] Hence, discrete-time methods are more adequate for this duration analysis. Furthermore, discrete-time duration models have the important advantage of allowing for the inclusion of time-varying covariates.

A discrete-time version of the proportional hazards model was developed by Prentice and Gloeckler (1978).[10] The respective discrete-time hazard function is given by:

$$\begin{aligned} P_{it} &= \Pr\left[T_i = t \mid T_i \geq t, \mathbf{x}_{it}\right] = 1 - e^{-h_t e^{\boldsymbol{\beta}'\mathbf{x}_{it}}} = 1 - e^{-e^{\theta_t + \boldsymbol{\beta}'\mathbf{x}_{it}}} \\ &\Leftrightarrow \ln\left[-\ln(1 - P_{it})\right] = \theta_t + \boldsymbol{\beta}'\mathbf{x}_{it} \end{aligned}, \qquad \textbf{(4)}$$

which is equivalent to the complementary log-log (or cloglog) function, where θ_t $(= \ln h_t)$ represents the logarithm of an unspecified (baseline hazard) function of time and $\mathbf{x}_{it}$ is a vector of time-varying explanatory variables. One suitable and quite popular specification for θ_t is the discrete-time analogue to the Weibull model, which yields:[11]

$$\theta_t = \ln h_t = \alpha + (p-1)\ln t\,. \qquad \textbf{(5)}$$

Other more flexible specifications can be considered instead of the Weibull, like: (i) a polynomial-in-time specification ($\theta_t = \alpha_0 + \alpha_1 t + \alpha_2 t^2 + \alpha_3 t^3 + \ldots$), where we may have linear, quadratic, cubic or other polynomial specifications for the hazard function; (ii)

[8] They are censored (c_i=0) if the sample period under analysis ends before the end of the incumbency; when a party leaves office in the observed sample period they are not censored (c_i=1).

[9] Allison (1982, p.70) states that when those "discrete units are very small, relative to the rate of event occurrence, it is usually acceptable to ignore the discreteness and treat time as if it was measured continuously. [However,] when the time units are very large – months, quarters, years, or decades – this treatment becomes problematic."

[10] These models are analysed in detail by Prentice and Gloeckler (1978), Allison (1982) and Kiefer (1988).

[11] Note that $\theta_t = \ln h_t = \ln(\gamma p t^{p-1}) = \alpha + (p-1)\ln t$, with $\alpha = \ln(\gamma p)$ and $t = TLGov$.

piecewise-dummies – one dummy for each particular sub-period of time – where the hazard rate is assumed to be the same within each time-group but different between those groups ($\theta_t = \alpha_0 + \alpha_1 d_1 + \alpha_2 d_2 + ...$); (iii) or a fully non-parametric specification with one dummy for each value of *t* for which an event is reported (time-dummies). Given there flexibility, some of these alternatives will also be evaluated in this study.

Prentice and Gloeckler (1978) and Allison (1982) show that discrete-time log-likelihood function for a sample of $i = 1,...,n$ spells can be written as follows:

$$\ln L = \sum_{i=1}^{n} \sum_{j=1}^{t_i} y_{it} \ln\left(\frac{P_{ij}}{1-P_{ij}}\right) + \sum_{i=1}^{n} \sum_{j=1}^{t_i} \ln\left(1-P_{ij}\right), \qquad \textbf{(6)}$$

where the dummy variable y_{it} is equal to 1 if party's *i* incumbency ends at time *t*, and 0 otherwise. The model will be estimated by Maximum Likelihood substituting P_{ij} by **(4)** and using one of the above specifications of θ_t for the baseline hazard function.

4. Empirical results

We start the empirical analysis presenting the hazard rates for the number of terms in office. Table 3 shows the pattern of the 385 observed tenure spells that ended or were censored at each of the 8 terms identified for the sample period considered in this study. The second column shows the total number of spells at risk of ending in the respective term, while the third column indicates how many spells ended at each term. A spell is censored when it has not ended by 2005. The estimates of the hazard rate presented in column 5 were obtained dividing the number of spells that ended by the total number of spells at risk at that term. The last column presents the evolution of the hazard rates and shows that the conditional probability of an incumbency spell ending at term *t*, given that it

has not ended yet, tends to increase over time, i.e. over the terms.[12] Hence, we have here some indication for the presence of positive duration dependence in local governments' tenure.

[Insert Table 3 around here]

A deeper statistical examination of this issue is provided in Table 4 with a parametric (continuous-time and discrete-time) duration analysis. For each estimation – besides the estimated coefficients and the respective robust standard errors – we present the value of the log-likelihood function (LogL), the Akaike information criterion (AIC), the Schwarz Bayesian information criterion (SBIC), the likelihood ration index (LRI),[13] the number of observations and the number of censored observations.

We start by estimating a simple continuous-time Weibull model.[14] Results provide evidence of positive duration dependence in parties tenure at the local level, since the duration dependence parameter (p) is statistically greater than 1. Moreover, the statistical analysis of the second derivative of the baseline hazard function ($h_0(t) = \gamma p t^{p-1}$) indicates the presence of decreasing positive duration dependence (p is statistically lower than 2), which means that the probability of incumbency termination at the end of term t, given that they are in office at term t, increases over time but at a decreasing rate.[15] The evolution of

[12] Note, however, that the slump of the hazard rates in the fourth and fifth terms may indicate that the trend might not be linear or monotonically increasing. This is an important issue that we will explore in this study. Nevertheless, as a starting point, we rely on the assumption of an underlying monotonic increasing trend.

[13] The LRI is a measure of fit for discrete choice models, equivalent to the R^2 in the linear OLS model, also called "pseudo-R^2".

[14] As the relevant economic, political and individual variables are time-varying, only the duration dependence parameter is estimated in this continuous-time model.

[15] See Castro (2010, p. 354) for details on the analysis of the second derivative of the baseline hazard function.

the hazard rates presented in Table 3 has already pointed out to that fact. This "decreasing rate" means that there is a reasonable group of local incumbent parties that tend to remain in office even after several terms.

[Insert Table 4 around here]

Given the drawbacks mentioned above for the continuous-time duration model, we present next the results from the estimation of discrete-time duration models. We start by assuming the following specification for the logarithm of the baseline hazard function in the discrete-time cloglog model: $\theta_t = \alpha + (p-1)\ln t$, where t measures the number of terms in office (here, t=*TLGov*). The results from the estimation of this model, without any additional regressor, confirm the findings of the continuous-time model: the likelihood of a party leaving the office increases as each term goes by, but at a decreasing rate.

In addition to the length of time in office, we include in the model some economic, political and individual variables that are expected to affect party tenure at the municipal level. Ignoring the effects of those conditionings may generate an omitted variables problem. The evidence of positive duration dependence is not affected with the inclusion of those time-varying regressors (see columns 3-7).

Regarding the economic environment, we test for the effects of some (available) local economic variables, as it is natural that an incumbent party is more likely to be defeated when the economy is not performing well. Those variables are the growth rate of the local income index (*Income*), the purchasing power index (*PurchPower*) and the unemployment rate (*UnempRate*).[16]. The results show that only the coefficient on

[16] We also tried several estimations with national variables, such growth rate of GDP, unemployment rate and inflation rate, but none of them has proved to be significant. Those results are not reported here, but they are available upon request.

PurchPower is statistically significant. Moreover, they indicate that an improvement in this indicator – which can be seen as a proxy for local economic conditions – contributes to an increase in the likelihood of a local government remaining in office.

Some political variables that are usually employed in the government termination literature are also added to the model. To collect the influence of the electoral or political support, we consider three variables: a dummy that takes value 1 when the ruling party has a majority of seats in the Municipal Council (*Majority*);[17] the party's percentage of votes obtained in the previous election (*PVotes*); and the difference in the percentage of votes between the ruling party and the second most voted party in the previous election (*DifPVotes*). To capture possible spillover effects from the national government to the local incumbent we use a dummy variable that takes value 1 when the local and national governments are of the same party (*SParty*). Additionally, we also consider a dummy variable that takes value 1 if the incumbent is a left-wing party to take into account the possibility of political orientation effects. We expect that those variables are relevant to explain parties' tenure at the local level, however, only the coefficients on the political and electoral support (*Majority*, *PVotes* and *DifPVotes*) are highly significant. As expected, the results show that parties with a strong majority government are more likely to remain in power. In fact, a higher percentage of votes in the previous elections contributes positively for the accumulation of the necessary political capital that helps parties to remain in office for longer periods of time.

The coefficient on *SParty* is only marginally significant, indicating that local governments of the same party as the national government tend to leave office sooner. This indicates that they may be affected by negative spillovers from a general time erosion effect of national government's popularity.

[17] Due to the Portuguese governing framework at the local level, this scenario actually reflects a majoritarian ruling.

Some additional variables are used to control for the individual characteristics of the mayor (i.e. the leader of the local party in office), like age and residence in the Municipality, but only age has proved to be relevant. Its coefficient indicates a positive impact on the likelihood of its party's leaving the office. Hence, the permanence of a party in office becomes at risk when its leader is or becomes older. Three dummy variables that take into account the dimension or importance of the Municipality (*D_Dim*) were also included in regressions 6 and 7. The idea is to check whether the power and higher visibility of bigger Municipalities affect the pattern of local governments' tenure. The results show that it might not be the case. In fact, the likelihood of government termination is only marginally lower in the "big" municipalities than in "the two biggest" ones. The results do not improve even when *DifPVotes* is used, instead of *PVotes*, to capture the electoral support effects (see column 7). Moreover, in some other experiments – not reported here – none of the *D_Dim* coefficients proved to be statistically significant. Therefore, they are not considered in the other regressions reported in this paper.

The Weibull model, as a parametric model, imposes a restrictive constraint on the shape of the hazard, since its discrete distribution – as well as its continuous equivalent – can only rise or decline monotonically. However, this pattern may not be empirically realistic. In fact, in Table 3 we noticed the presence of a slump in the hazard rates at the fourth and fifth terms, which might raise doubts about the adequacy of a monotonically increasing Weibull distribution to these data. Therefore, other more flexible specifications should be tested. We start by considering, in the cloglog framework, some polynomial-in-time specifications for the hazard function: linear, quadratic and cubic.

Taking into account the results presented in Table 5, we conclude that the cubic specification seems to be the one best fitting the data.[18] That is the case, not only because

[18] The covariates used in the regressions reported in Table 5 are the ones that proved to be, at least, marginally significant in the previous estimations, in order to keep the analysis as parsimonious as possible. In particular,

all the three coefficients in the cubic polynomial specification (column 3) are highly significant, but also because the LR tests have rejected the linear and quadratic specifications.[19] Moreover, the cubic specification of *TLGov* seems to be a better specification than the selected discrete Weibull estimation (see Table 4, column 5). Notice, for example, that the value of the log-likelihood and the LRI are higher in the former than in the later, the AIC and the SBIC are lower and the LR test also favours the cubic specification.[20] Hence, we can rely on the polynomial-in-time cubic specification for *TLGov* to analyse the tenure of Portuguese local governments.

[Insert Table 5 around here]

The results provided by this estimation are quite interesting and indicate that the likelihood of parties leaving office increases over time (the coefficient on *TLGov* is positive), but only until a certain number of terms; then it decreases (the coefficient on *TLGov2* is negative), but after a while it starts to increase again (the coefficient on *TLGov3* is positive). In fact, this evidence is in line with the hazard rates presented in Table 3

---

we use as benchmark the variables employed in the cloglog Weibull estimation reported in column 5 of Table 4. The preference for *PVotes* instead of *Majority* (and *DifPVotes*) is due to several reasons. First, the regression with *PVotes* presents higher values for the log-likelihood and the LRI and lower values for the AIC and the SBIC, which favours this regression in comparison with the equivalent with *Majority* (column 4, Table 4). Second, the estimated value for the duration dependence parameter is higher when the *PVotes* is used. Third, why should we prefer a dummy when we observe the underlying continuum of values used to generate it? And finally, there are no empirical gains from using *DifPVotes* instead of *PVotes*. Nevertheless, results have proved to be quite similar when *Majority* or even *DifPVotes* are used instead of *PVotes*. Those results are not reported here, but they are available upon request.

[19] The likelihood ratio tests for the comparisons between the cubic specification for the hazard rate and the linear and quadratic ones are, respectively, 18.6 and 12.4, which clearly favours the cubic specification at a level of significance of 5%. In fact the statistical significance in the polynomial cubic specification is much higher than in the linear and quadratic ones.

[20] $LR = 2(371.2\text{-}363.8) = 14.80 > \chi^2_{(2);5\%} = 5.99$.

(notice the slump in terms 4 and 5). Moreover, the estimated hazard function plotted in Figure 1 for the clolog-cubic specification – obtained from the regression 3 in Table 5 – also confirms this behaviour:[21] the likelihood of incumbent parties leaving office increases until the third term, but then it decreases until about the sixth before starting to increase again. This result is in accordance with the "sophomore" effect found by Erikson (1972), Alford and Hibbing (1981) and Finocchiaro and Lin (2000). The rate of survival in office, in the first terms, can be affected by the process of building up reputation. However, Erikson's (1972) finds that the inversion occurs in the second electoral contest, meaning that, for Portuguese local governments, this process seems to be harder as it takes one extra term to invert. Our results capture yet another interesting effect: after the sixth mandate the parties' likelihood to leave office starts to increase again. Probably, in average, at this point the costs of ruling become dominant making it harder for the incumbent party to be reelected.

[Insert Figure 1 around here]

This evidence contrasts with the monotonically increasing hazard rate obtained for the Weibull specification (see clolog-weibull in Figure 1, which was estimated from regression 5 in Table 4). Even though some doubts may remain regarding the configuration of the hazard function, those can be clarified with the estimation of a more flexible specification that imposes no constraints on the shape of the hazard: a fully non-parametric or time-dummies specification with one dummy for each value of *t* for which an event is

[21] All the estimated hazard functions plotted in Figure 1 where obtained from the respective regression for an "average" government whose values for the covariates are set at their sample means, except for the dummy *SParty* for which their sample mode (0) was used.

reported. Now the coefficients on the dummies allow for a free determination of the shape of the hazard function.

The results for the estimation of a time-dummies specification are presented in column 4 of Table 5 and show that the increase in the likelihood of a party leaving power is not linear. The coefficients do not increase steadily over the terms. Instead, they evolve in jumps or ups and downs, which are very clearer in Figure 1 (cloglog-dummy). Nevertheless, it resembles more the cloglog-cubic than the cloglog-weibull hazard function: the likelihood of a party leaving office increases in the first terms, then decreases (with a jump in the middle) before increasing again.

According to Beck et al. (1998) and Finocchiaro and Lin (2000), one drawback of using dummy variables in these models is the fact that the respective estimated hazard function is likely to "zig-zag" in time.[22] That is indeed the case here. Hence, the results may not be easily interpretable. Beck at al. (1998) suggest using "natural cubic splines" to smooth out the coefficients and the hazard function based on them. Now the vector of dummy variables will be replaced by a vector of spline basis variables which are cubic polynomials of *t* (or *TLGov*). Since the number of spline variables needed is lower than the number of time dummies, statistical significance will be easier to achieve and the time-dependence of the hazard function is straightforward to test.

The results with three cubic splines are presented in column 5 of Table 5 and show that the coefficients on the covariates remain statistically significant and present the expected signs. Moreover, the coefficients on the splines are also highly significant.[23] The best way of interpreting them is to look at the respective estimated hazard function in

[22] Additionally, since there is usually high collinearity among the dummy variables, individual coefficient estimates tend to have large standard errors.

[23] The three spline basis variables correspond to "knots" at terms 1, 2, 4, and 8, respectively. This set of knots was chosen because it produces statistically significant variables and the lowest p-value in rejecting the null model in likelihood ratio tests. Two, three and five-knot solutions were also tried, but none of them produced better results. Those results are not reported here, but they are available upon request.

Figure 1 (cloglog-spline). This hazard function adjusts quite well to the cloglog-dummy hazard function, but the most interesting finding is that the cloglog-spline specification is corroborating the results obtained with the parametric-in-time cubic specification. In particular, they confirm that the likelihood of incumbent parties leaving office behaves in a nonlinear way, starting by increasing until the third term, then decreasing until the fifth term before increasing again.

In a final analysis, we decided to test the robustness of the cloglog model used in the study of Portuguese local governments' tenure. Instead of a cloglog model, Finocchiaro and Lin (2000) employed a logit model to study the Congressional tenure in the United States and found that a logit-dummy and a logit-spline were good specifications to characterise the time in office. To check whether those specifications also fit to the Portuguese case, we provide a robustness analysis where a logit model is used to estimate the probability of a party leaving office (leaving=1; 0, otherwise), using the same term-dummies (column 6), splines (column 7) and the other covariates.

Although its estimated coefficients are not necessarily the discrete-time equivalent of the underlying continuous-time model, the findings are similar. However, the statistical significance of some coefficients decreases and the logit specifications are not able to capture the cubic behaviour that characterizes the Portuguese parties' tenure, as can be confirmed in Figure 1 (logit-dummy and logit-spline). Hence, the cloglog-cubic specification remains as the preferable specification to study the duration of Portuguese local governments' incumbency and the one that provides the best characterization for the likelihood of a party leaving office after serving for a certain number of terms.

5. Conclusions

This study analyses the presence of duration dependence in Portuguese local governments' tenure and the impact of some economic and political variables on the likelihood of a party leaving the office after some terms.

Estimating continuous and discrete-time Weibull duration models over a data set that covers all Portuguese mainland municipalities and electoral terms for the period 1979-2005, this study finds evidence of positive duration dependence in local governance. In particular, our results show that the more terms a party remains in office, the higher the likelihood of leaving the office at the end of the current term is and the shorter its tenure will be. Moreover, our findings also indicate that this likelihood increases but at a decreasing rate, which means that there is a group of local governments that tend to persist in office.

However, more flexible polynomial-in-time and time-dummies specifications show that the behaviour of that likelihood is not monotonically increasing but behaves in a nonlinear way: the likelihood of a local government leaving office increases but only until the third term, then it decreases until about the sixth term before starting to increase again. This may indicate that the rate of survival in office, in the first terms, can be affected by the process of building up reputation. Moreover, as the likelihood of a party leaving office decreases precisely after the third term, we may argue that we have here some interesting evidence to support the rule, established in 2005, of a limit of three terms in office for Portuguese mayors.

These results for the duration of local party governments are in line with the "sophomore" effect found by Erikson (1972), Alford and Hibbing (1981) and Finocchiaro and Lin (2000). Additionally, they show that the hazards rate is not constant or monotonically increasing, as found in the studies of King et al. (1990), Warwick and Easton (1992), Warwick (1994) and Alt and King (1994) in their analysis for the duration

of national governments, cabinets and political leaders. Instead, our results for the duration of local party governments point out to a non-monotonic hazard rate.

Finally, regarding the additional economic and political conditionings, this study shows that the length of local governments' tenure tends to increase when local economic environment is favourable and when they have enough political support.

References

Alesina, A. , N. Roubini, and G. Cohen 1997. *Political Cycles and the Macroeconomy*. MIT Press.

Allison, P., 1982. Discrete-time methods for the analysis of event histories. *Sociological Methodology* 13, 61-98.

Alt, J., King, G. 1994. Transfers of governmental power: the meaning of time dependence. *Comparative Political Studies* 27, 190-210.

Beck, N., Katz, J., Tucker, R., 1998. Taking Time Seriously: Time-Series-Cross-Section Analysis with a Binary Dependent Variable. *American Journal of Political Science* 42, 1260-1288.

Bienen, H., & van deWalle, N. 1991. *Of time and power: Leadership duration in the modern world*. Stanford, CA: Stanford University Press.

Browne, EC, Frendreis, JP, Gleiber, D. 1984. An "events" approach to the problem of cabinet stability. *Comparative Political Studies* 17, 167-97.

Castro, V., 2010. The duration of economic expansions and recessions: More than duration dependence. Journal of Macroeconomics 32, 347-365.

Diermeier, D., Stevenson, R. 1999. Cabinet survival and competing risks. *American journal of Political Science* 43: 1051-98.

Diermeier, D., Stevenson, R. 2000. Cabinet terminations and critical events. *American Political Science review* 94, 627-40.

Diermeier, D., Merlo, A. 2000. Government turnover in parliamentary democracies. *Journal of Economic Theory* 94, 46-59.

Dodd, LC 1976, *Coalitions in parliamentary government*. Princeton, NJ: Princeton University press.

Finocchiaro, C., Lin, T., 2000. The hazards of incumbency: An event history analysis of congressional tenure. Mimeo. Presented at the 58th *Annual Meeting of the Midwest*

Political Science Association, April 27-30, 2000, Palmer House Hilton, Chicago, Illinois.

Frendreis, JP, Gleiber, D., Browne, EC 1986. The study of cabinet dissolutions in parliamentary democracies. *Legislative Studies Quarterly* 11, 619-28.

Hibbs, D.A. Jr. 1977. Political Parties and Macroeconomic Policy. *American Political Science Review* 71, 1467–87.

Kiefer, N., 1988. Economic duration data and hazard functions. *Journal of Economic Literature* 26, 646-679.

King, G., Gelman, A., Burns, N., Laver, M. 1990. A Unified model of cabinet dissolution in parliamentary democracies. *American journal of Political Science* 34, 846-71.

Laver, M. 1974. Dynamic factors in government coalition formation. *European Journal of political Research* 2: 259-70.

Lijphart, A. 1999. *Patterns of democracy: government forms and performance in thirty-six countries*. New Haven, CT: Yale University press.

Lin, T. and Guillen, M. 1998. The Rising Hazards of Party Incumbency: A Discrete Renewal Analysis. *Political Analysis,* 7(1), 31-57.

Maeda, K., Nishikawa, M. 2006. Duration of Party Control in Parliamentary and Presidential Governments: A Study of 65 Democracies, 1950 to 1998. *Comparative Political Studies* 39(3) 352-374.

Mueller, J.E. 1970. Presidential popularity from Truman to Johnson. *American Political Science Review*, 64, 18-23.

Prentice, R. L., Gloeckler, L. A., 1978. Regression analysis of grouped survival data with application to the breast cancer data. *Biometrics* 34, 57-67.Rose, Richard and Thomas T. Mackie. 1983. “Incumbency in Government: Asset or Liability?” in Hans Daalder and Peter Mair eds. *Western European Party Systems*. London and Beverly Hills: Sage.

Strom K. 1985. Party goals and government performance in parliamentary democracies. *American Political Science review* 79, 738-54.

Taylor M, and Herman V. 1971. Party system and government stability. *American Political Science review* 65, 28-37.

Veiga, F., Veiga, L. 2004. The determinants of vote intentions in Portugal. *Public Choice*, 118(3-4), 341-364.

Warwick, P. 1979. The durability of coalition governments in parliamentary democracies. *Comparative Political Studies* 11, 465-98.

Warwick, P. 1992. Rising hazards: an underlying dynamic in parliamentary government. *American journal of Political Science* 36, 857-76.

Warwick, P. 1994. *Government Survival in parliamentary democracies*. Cambridge, UK: Cambridge University Press.

Warwick, P., Easton S. 1992. The cabinet stability controversy. New perspectives on a classic problem. *American journal of Political Science* 36, 122-46.

List of Tables

Table 1. Description of the variables

Variables	Description
TLGov	Time in local government, i.e. number of terms in office.
D_TLGov	Eight dummies for the time in local government: 1=one term in office; 2=two terms in office; (…); 8=eight terms in office.
Income	Growth rate of the local income index.
PurchPower	Growth rate of the local purchasing power index.
UnempRate	Local unemployment rate.
Majority	Dummy variable that takes value 1 if the party in government has a majority.
PVotes	Percentage of votes obtained by the party in the previous election.
DifPVotes	Difference in the percentage of votes between the party in government and the second most voted party in the municipality in the previous election.
SParty	Dummy variable that takes value 1 if the local and national governments are of the same party; 0, otherwise.
Left	Dummy variable that takes value 1 if the party in the local government is a left-wing party.
Age	Age of the mayor/political leader of the local government.
Residence	Dummy variable that takes value 1 if the mayor lives in the municipality where he or she was elected; 0, otherwise.
D_Dim	Four dummies for the dimension and importance of the council: 1=the two biggest councils (Porto and Lisbon); 2=big; 3=medium; 4=the smallest.

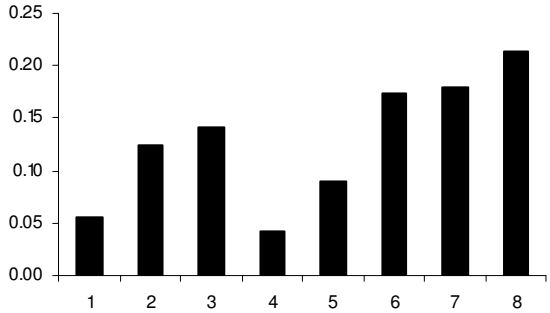
Sources: Portuguese National Institute of Statistics (INE); Marktest; *Finanças Municipais* (Municipal Finances – DGAL); Technical Staff for Matters Concerning the Electoral Process (STAPE).

Table 2. Descriptive statistics

Variables	Obs.	Mean	S.D.	Min.	Max.
TLGov	795	3.70	2.37	1	8
Income	795	0.84	5.17	-40.24	70.00
PurchPower	795	4.67	7.35	-30.00	69.17
UnempRate	795	6.17	2.52	1.67	11.90
Majority	795	0.84	0.36	0	1
PVotes	795	51.14	8.29	29.94	78.72
DifPVotes	795	18.33	13.68	0.02	65.70
SParty	795	0.45	0.49	0	1
Left	795	0.46	1.01	0	1
Age	795	51.63	7.33	31	76
Residence	795	0.91	0.29	0	1

Sources: See Table 1.

Table 3. Hazard rates for terms in office

Term	Total	Ended	Censored	Hazard	Hazard rates
1	385	21	59	0.055	
2	305	38	42	0.125	
3	225	32	28	0.142	
4	165	7	25	0.042	
5	133	12	12	0.090	
6	109	19	6	0.174	
7	84	15	8	0.179	
8	61	13	48	0.213	

Notes: For sources, see Table 1. Hazard=Ended/Total.

Table 4. Continuous-time and discrete-time Weibull estimations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
p	1.685$^{+,d}$	1.177$^{+,d}$	1.191$^{+,d}$	1.185$^{+,d}$	1.289$^{+,d}$	1.294$^{+,d}$	1.300$^{+,d}$
	(0.086)	(0.101)	(0.107)	(0.107)	(0.112)	(0.115)	(0.113)
Income			-0.029				
			(0.020)				
PurchPower				-0.025**	-0.024**	-0.023*	-0.025**
				(0.013)	(0.012)	(0.012)	(0.013)
UnempRate						-0.027	-0.021
						(0.034)	(0.034)
Majority			-0.585***	-0.537***			
			(0.198)	(0.205)			
PVotes					-0.053***	-0.056***	
					(0.011)	(0.012)	
DifPVotes							-0.037***
							(0.007)
SParty			0.293*	0.276*	0.324*	0.260	0.203
			(0.165)	(0.166)	(0.168)	(0.173)	(0.169)
Left						0.107	0.134
						(0.166)	(0.162)
Age			0.041***	0.041***	0.039***	0.041***	0.041***
			(0.010)	(0.010)	(0.010)	(0.011)	(0.010)
Residence						0.521	0.528
						(0.352)	(0.355)
D_Dim2						-1.122*	-1.045*
						(0.604)	(0.600)
D_Dim3						-0.858	-0.868
						(0.593)	(0.589)
D_Dim4						-0.778	-0.835
						(0.593)	(0.588)
LogL	-299.4	-393.7	-381.0	-380.1	-371.2	-366.9	-365.2
AIC	602.9	791.4	774.0	772.1	754.4	757.8	754.5
SBIC	610.8	800.8	802.1	800.2	782.5	813.92	810.6
LRI	--	0.003	0.036	0.038	0.060	0.071	0.075
Observ.	385	795	795	795	795	795	795
Censored	157	157	157	157	157	157	157

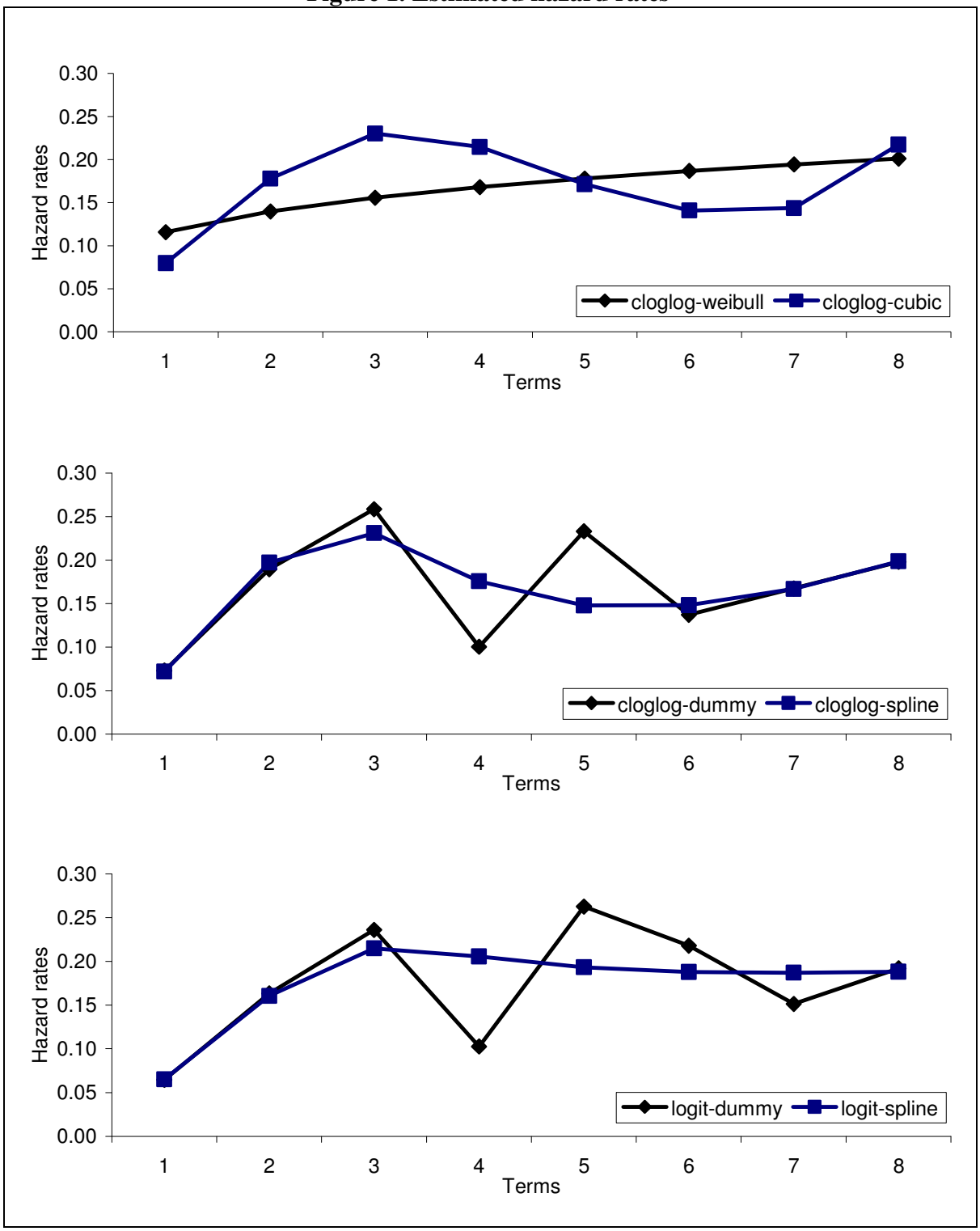
Notes: For sources, see Table 1. Robust standard errors for the estimated coefficients are in parentheses. Significance level at which the null hypothesis is rejected: ***, 1%; **, 5%; and *, 10%. The sign "+" indicates that *p* is significantly higher than 1 using a 5% one-sided test with robust standard errors; *d* indicates the presence of decreasing positive duration dependence at a 5% level. AIC=2[-LogL+*k*] and SBIC=2[-LogL+(*k*/2)Log*N*], where LogL is the log-likelihood for the estimated model, *k* is the number of regressors and *N* is the number of observations. LRI is the likelihood ration index or pseudo-R^2 (LRI=1-LogL/LogL_0, where L_0 is the likelihood of the model with only a constant term). "Censored" indicates de number of censored observations. Column (1) presents the results of a continuous-time Weibull model; Columns (2)-(7) show the results of discrete-time cloglog model.

Table 5. Other specifications for the baseline hazard function

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
TLGov	0.055	0.463***	2.088***				
	(0.034)	(0.170)	(0.514)				
TLGov2		-0.048**	-0.488***				
		(0.020)	(0.131)				
TLGov3			0.034***				
			(0.010)				
D_TLGov2				1.021***		1.037***	
				(0.292)		(0.357)	
D_TLGov3				1.374***		1.496***	
				(0.308)		(0.375)	
D_TLGov4				0.334		0.500	
				(0.443)		(0.499)	
D_TLGov5				1.254***		1.637***	
				(0.379)		(0.454)	
D_TLGov6				0.668**		1.392***	
				(0.337)		(0.377)	
D_TLGov7				0.885**		0.946**	
				(0.365)		(0.442)	
D_TLGov8				1.070***		1.234***	
				(0.380)		(0.433)	
Spline1					1.287***		1.156***
					(0.303)		(0.356)
Spline2					-10.054***		-7.172**
					(2.641)		(3.074)
Spline3					16.120***		10.990**
					(4.378)		(5.076)
PurchPower	-0.024**	-0.020*	-0.026**	-0.023**	-0.024**	-0.032**	-0.034**
	(0.012)	(0.012)	(0.013)	(0.013)	(0.013)	(0.013)	(0.014)
PVotes	-0.049***	-0.053***	-0.060***	-0.061***	-0.060***	-0.032**	-0.033***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.013)	(0.013)
SParty	0.292*	0.315*	0.307*	0.318*	0.317*	0.254	0.258
	(0.167)	(0.168)	(0.169)	(0.170)	(0.169)	(0.200)	(0.197)
Age	0.041***	0.040***	0.035***	0.034***	0.034***	0.047***	0.046***
	(0.010)	(0.010)	(0.011)	(0.011)	(0.011)	(0.014)	(0.013)
LogL	-373.1	-370.0	-363.8	-359.3	-362.5	-352.6	-356.5
AIC	758.2	754.0	743.6	742.6	741.0	729.3	729.1
SBIC	786.3.1	786.8	781.0	798.8	778.4	785.4	766.5
LRI	0.056	0.063	0.079	0.090	0.082	0.073	0.063
Observ.	795	795	795	795	795	795	795
Censored	157	157	157	157	157	--	--

Notes: See Table 3. Robust standard errors for the estimated coefficients are in parentheses. Significance level at which the null hypothesis is rejected: ***, 1%; **, 5%; and *, 10%. The cloglog regressions (1) to (3) were performed using polynomial baseline hazard functions: linear, quadratic and cubic, respectively. A cloglog model is also employed in estimations reported in columns (4) and (5). Fully non-parametric specifications with one dummy for each term, or value of *TLGov*, are used in regressions (4) and (6). A logit model is employed in the estimations reported in columns (6) and (7). In regressions (5) and (7) are considered three natural cubic splines of *TLGov*, with knots at terms 1, 2, 4 and 8.

Figure 1. Estimated hazard rates



Notes: Estimated hazard rates computed for each model evaluating the variables at their averages, except the dummy *SParty* that was evaluated at its mode (0).